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Southern Pine Beetle Fact Sheet Number 22

Setting Control Priorities Using Emergence:Attack Ratios— A Research Update

During outbreaks of the southern pine beetle (SPB), owners and managers of pine forests often must set priorities on which spots to control first. In addition, many spots with only a few infested trees die out and require no control at all. The efficiency and effectiveness of control efforts can be improved by limiting control to those spots that are most likely to remain active and increase in size (Billings and Pase 1979, Hedden and Billings 1979).

This fact sheet describes a method to determine the probability of a beetle spot increasing in size, remaining static, or declining. Another technique for setting control priorities was discussed in Southern Pine Beetle Fact Sheet Number 3 (USDA Forest Service 1979).

The method described here uses the ratio of the number of emerging brood adults to attacking parent adults, coupled with a secondary factor (basal area). The emergence:attack (E:A) ratio—formerly called attack:emergence ratio—has proved to be a reliable indicator of spot growth trend in Virginia, North Carolina, and north Georgia (Moore 1978). The approach has not been adequately tested in other regions of the South. Results using the E:A ratio with the basal area factor

suggest that spot growth trends may be predicted throughout the range of loblolly and shortleaf pines, particularly in areas where SPB activity is static.¹

The E:A ratio for SPB spots can be determined by counting the number of beetle attack points (entrance holes) and the number of brood emergence holes on representative samples of pine bark. Here's how to distinguish between attack and emergence holes.

Attack—Entrance holes are generally characterized by the presence of pitch tubes on the outside of the bark. Pitch tubes are sticky globs of resin exuded by the tree in response to beetle attack, but may be small or missing during periods of very dry weather. After constructing galleries, mating, and laying eggs, some parent adults emerge from trees by boring outward through the bark. These should be distinguished from brood emergence holes.

Emergence—Brood emergence holes may be differentiated from holes made by emerging parent adults. After brood adults have developed in pupal chambers, they emerge through individual exit holes in the bark. Hold the bark sample up in the air. Light will shine through the holes made by parent adults emerging from the main galleries—the ones we are not interested in—but light will not shine through the brood emergence holes. To calculate the number of brood emergence holes, count all pitch-free holes on the sample and subtract those with light shining through.

¹Moore, G.E., G.D. Hertel, and H. Bhattacharyya. 1979 (Unpublished). Southern pine beetle attack:emergence ratio and stand factors for predicting spot trend. USDA For. Serv., Southeast. For. Exp. Stn., Asheville, N.C. Expanded Southern Pine Beetle Program, Final Report. 25 p.

Sampling—Take a single bark sample (12 x 12 inch) at breast height from each of two to five (preferably five) trees near the expanding edge of the SPB spot. Delay sampling until the brood has emerged but before secondary beetle damage has obscured SPB galleries. Next, compute an average ratio of emergence holes to attack holes for each sample. Finally, calculate the average ratio for all the sample trees.

RESULTS

Predictions based upon the E:A ratio have been correct about 70 percent of the time in the Atlantic Coastal states. In practice, the best results have been obtained by using the ratio to predict spot growth trends (decline, static, increase) for the next 4 months; however, Morris (1975) successfully predicted the next summer's spot growth trend from fall measurements.

An E:A ratio greater than 10:1 indicates a spot growth increase. It indicates that the number of infested trees should be at least 1.5 times as great at the end of 4 months as the number of currently infested trees. Control measures should be considered.

An E:A ratio between 5:1 and 10:1 indicates a static rate of spot growth. The number of infested trees is not likely to change greatly; it may increase or decrease somewhat, but the spot should remain active. Four months later, between 0.5 and 1.5 times as many trees could be infested.

An E:A ratio of less than 5:1 indicates that the number of infested trees at the end of 4 months should be less than half the number of currently infested trees. These spots will probably go inactive.

In expanding spots, the basal area of the uninfested timber in front of the most recently attacked trees may be an indicator of potential spot growth. This factor is particularly helpful where the E:A ratio is between 5:1 and 10:1. Entomologists have recognized for many years that dense pine stands favor SPB spot growth. It has also been shown that mixed pine-hardwood stands are less susceptible than pure pine stands (Leuschner et al. 1976). Stands where the pine basal area exceeds 120 square feet/acre are particularly favorable to spot expansion, while stands with basal areas of 80 to 120 have a moderate growth potential, and stands of less than 80 generally do not favor spot growth.

Thus, in a stand with a low E:A ratio and low basal area, control is unnecessary; where both the E:A ratio and basal area are high, immediate control is normally required. Some special considerations are needed where only the basal area is high and the E:A ratio is moderate to low. In that case, spot growth might continue if the E:A ratio is sufficiently above 5:1, because a constant supply of brood adults is available to attack new trees. High E:A ratios alone represent a risk for spot expansion as long as susceptible pines are present at the head of the infestation.

This fact sheet was prepared by Gordon Moore, research entomologist, USDA Forest Service, Southeastern Forest Experiment Station. He is studying the reliability of the predictors just described and would appreciate comments on results obtained from using these procedures. You can write to him at P.O. Box 12254, Research Triangle Park, NC 27709.

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